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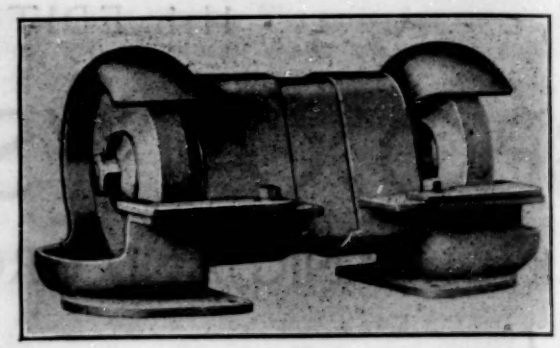

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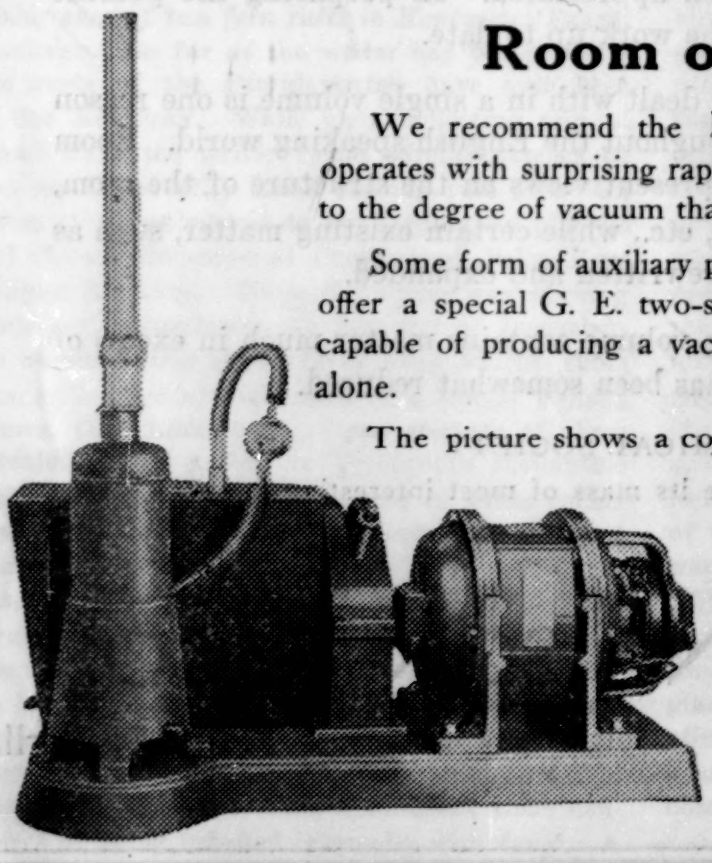

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SCIENCE

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THE BEGINNINGS OF PHYSIOLOGICAL RESEARCH IN AMERICA[1]

THE distinguished society of which this gathering represents a chapter has for its main purpose the exploitation of scientific research.

Every interested person who has survived the sixth decade of life must remember that time when the term "research" was the exclusive shibboleth of a very small fraction of the world community whose individuals were scattered singly or in tiny groups throughout civilized lands, who were unknown by and without influence upon the great public whom they served.

To-day the word is in the mouth of the man on the street, and every newspaper typesetter is familiar with its letters.

This extension of vogue is, of course, due to the common knowledge that it is through research alone that the vast acceleration in the accumulation of bodily comforts, of mechanisms for the control of natural forces, of means for the prevention of human ills has been made possible.

One salutary fruit of the world war has been the popular apprehension that its most infernal agencies on the one hand and its saving graces on the other all were born in the laboratories of science. Man bows to power and gladly contributes to the means for its acquisition.

The very popularity of the theme under discussion is fraught with danger to the fine essence on which its flavor depends. "Research" implies not only a problem but a mind—a certain type of mind. So modern is the content of the term that the English language has failed to develop a graceful name to characterize its votary who is, above all, a truth-seeker.

"Investigator" is clumsy; "researcher" is crude; the French "savant" is inadequate; the German "Forscher" seems more fit. It would be a boon should some student of language fish out from our linguistic melting pot some characterization, brief, smooth and descriptive.

It is a type of mind that is to be defined, not talent or genius, but an impulse to wonder, to inquire and to understand. When the problem is solved its spell is broken; "practical" results have no interest except as demonstrations of the abstract truth and progenitors of new phases of thought. The urge of the in-

[1] Read before the Colorado Chapter of Sigma Xi, June 9, 1923.

vestigator is the development of truth; the direction is subsidiary. With adequate intellectual machinery we may witness a Leonardo da Vinci, a Harvey, a Newton, a Thomas Young, a Helmholtz, a Pasteur or a Dante, a Shakespeare or a Goethe. They all wonder, inquire, construct, create because they understand. The essential spirit of the investigator pervades much of our literature not ostensibly devoted to discovery; it bristles in a fugitive article of A. Graham Bell's and is manifestly revealed in many biographies, as in that of the late Walter H. Page.

The original thinker often, *per se*, like "the lunatic, the lover and the poet is of imagination all compact," but, as in any efficient material engine, his motive power is steadied by a regulating device which, in his case, is provided by scientific training.

The subject-matter of research may be divided, after the manner of a moral code, according to the *intention* on which the endeavor is based, into abstract or pure science, on the one hand, and applied or industrial science, including invention, on the other. Scholarship and learning, however necessary to a productive technique, have no specific relation to research. Mere erudition is not fecund unless it finds a resonant receptive apparatus in the human brain.

My contention is that the characteristic of the original investigator is his mental predisposition, probably essentially a hereditary quality, obvious in every infant, which tends to submergence in later life, but which may be fostered and intensified by culture.

There has been a great change in mental or perhaps I should say ethical attitude among educationalists since the late seventies, the period treated of in these remarks. It was then a real war between the classics and science as to their relative fitness for culture of the human intellect. Intrenched in tradition the so-called "humanists" used all their polished weapons and tactics to repulse the onslaught of the uncultured hordes that threatened their stronghold. And then it was found that the very life and savor of the classics itself depended on the application to it of the same point of view and method with which the scientist consistently and consciously developed his armamentarium.

Sir. T. Clifford Allbutt,[2] in his recent characteristic essays notes, "the humanists never very friendly to science. . . . Disliking the raw anatomy of knowledge, with what they called 'The Classics' they built a walled pleasaunce for themselves and dwelt therein, raising florist's blooms and cut flowers, till Wolfe and Schliemann began to throw stones over the fence." Perhaps more than to any other person the entering wedge of science into the respectable educational curriculum was due to the blows of that doughty warrior, Thomas H. Huxley, who was, indeed, known among his intimates as the "General." And no fitter personality could have been found to lead the actual assault against the university stronghold than his intimate coadjutor, Michael Foster. Even so, Foster's increasingly popular course of physiology at Cambridge was long generally stigmatized as "stinks."

Then, in our own country the bomb was thrown by Charles Francis Adams, if I remember correctly, into the placid ranks of our own most conservative university in the form of an essay on "The modern fetich," the fetich being the assumed aggrandizement of culture through the classics.

In those early days a line was sharply drawn between pure and applied science. For the latter was mixed with "business," which all tradition taught was of a mercenary genus. The scientific man who let himself be lured as principal or accessory into the gainful pursuit of knowledge at once hopelessly lost caste. This was before the sunrise of industrial research in science, though already slight glimmerings of the dawn lighted the sky. It has been indeed a remarkable, if inevitable and rational, revolution which to-day has added to the battalions of industry so large a contingent of the best equipped investigators as to make of industrial science a most important agency for the generation of knowledge.

The same general change that has marked the progress of science has been reflected to a degree in features of medical ethics. The profound aversion to forms of belief, as in homeopathy, has given way to tolerance and regulation by broad rules of conduct. But ever new systems of therapeutics are projecting themselves upon us and only time and patience and the spirit of science will suffice to gradually smelt the noble metal from the base—for all beliefs are mixtures. It is interesting to observe the modification of ethical judgments which has already been manifested through a broader perception of the supremacy of the claims of human welfare as exampled, for instance, in the approved patenting of remedial agencies which would be likely to accomplish harm through unregulated exploitation.

Immemorially the medical curriculum has combined these complementary if not antipathetic relations of scientific instruction, the field of thought and the field of practice, however vastly predominant in area the latter. It would be ruinous to progress and efficiency to displace either. Though we sing the attributes of research in pure science, it is the application in practice that really and immediately counts. The two activities are fairly portrayed in the parts played in a reflex action by the afferent impulse and the central mechanism, on the one hand, and the motor impulse

[2] Sir T. Clifford Allbutt, "Greek Medicine in Rome," 1921, p. 5.

and its end organ, on the other; each alone is futile, but together they accomplish a purpose.

In these latter days there has developed what seems to be a final ideal for the union of the antithetic relations of science and practice.

It is witnessed in the, as yet groping, institution of schools of preventive medicine, where the highest flights of the trained imagination of the investigator may find full scope with the single proviso that they be so reined as to effect a single purpose—the welfare of living creatures.

Within the past half century we have seen realized the ideal of a purpose so directed in the life of Pasteur. Thus does moral philosophy come to its own; the stone rejected of the builders has become the chief of the corner. The world events of the past decade form a pedestal, grave-deep, on which to carve this slogan of science.

It seems as though the evolution of education were perceptibly drawing closer to the refrain of the book of Ecclesiastes, where wisdom is pointed as the goal of the seeker; but the doctrine there is urged for a reward, the boon of self-aggrandizement. We may aspire to higher claims and seek to realize the injunction of Christ, to work for the good of others.

The dangers of accomplishment are very real. Few characters can withstand the unwonted temptations which swarm in sudden riches. Our accelerating affluence of discovery in science pure and applied, the insidious examples of luxury in the life of the unworthy threaten the character of the scientific cult. The horseless vehicle outclasses legs and we must look to it that our finest possessions, physical and ethical, do not shrivel in atrophy from disuse. It is the youth and infant of to-day who must be trained to catch the torch from the failing hand of age in the great relay race of scientific progress. The observer with a retrospect of 40 years who compares the ideals of then and now must feel a vague uneasiness that the spirit and language of pure science are fast becoming obsolescent for the newer generations. The guinea-piece damned by John Hunter seems to have come to its own.

It is not going too far afield to here applaud the isolated effort which, albeit a feeble one, the medical profession, the greatest school of practical ethics known to-day, here and there is making to withstand the surges of commercialism.

The "whole time" chairs of practical medicine in university medical departments testify to the perception of our imminent danger and the intention to combat it. Modified in detail as the plan must be with knowledge gained from experience, it gives confidence that our real leaders are prepared to grapple with the dangers that confront us.

Preventive medicine even more than the remedial practice of the art bears the stamp of wisdom; and as a spiritual exhibit of altruism it is unsoiled with the stain, "which will not out," of calculated money rewards in actual practice.

But I came here to talk about the beginnings of physiological research in America, for it had been my good fortune to be a personal witness of what might be called the birth of organized research in physiology in this country, and to have been on intimate terms with its accouchers.

There seemed reason to believe that a personal description of some of those who deserve to live in the history of science might not be without value and entertainment.

A judicial estimate of the importance of men and events is admittedly impossible until long after they are passed and gone.

This is largely because our own immediate interests are sensibly involved in recent history; but the final verdict more nearly approaches truth the greater the number of accurate, eye-witnessed facts it has to build on.

I venture to assert that the foundation of what I have called organized physiological research in America was laid by Henry Newell Martin in the biological laboratory of Johns Hopkins University in the fall of 1876.

Do not misunderstand me to say that no physiological research had preceded this era.

None will fail to recall the undying names of Beaumont, that very personification of the genius of solitary research, of Brown-Séquard, of Weir Mitchell, of H. P. Bowditch, of H. C. Wood and many others. But these were widely isolated individuals who, separated from their generation, obeyed the call within them. High as have been the achievements of isolated great men working alone, especially in the history of English physiology, their momentum was bound to fail when not sustained by the contemporary appreciation and critical judgment of a large body of scientific men.

In the late seventies there was no such thing as physiology, in the modern sense, in America. There were not half a dozen working physiologists, no well-equipped laboratories, no students and no demand for scientific foundation in medicine either on the part of the medical profession or the public.

The only physiology was that of the text-books of which those of J. C. Dalton and of the younger Austin Flint, both of New York, were the foremost.

When a medical graduate managed to get a place on the teaching staff of a medical school, almost invariably "proprietary," it was physiology which he was assigned to expound. In the United States pathology had not been born and clinical microscopy had not begun gestation.

The ambitious and thinking student could find among us no answer to his questions nor opportunity for any but clinical training. He who could not afford to go to Germany or France was compelled to remain in ignorance. When one such, who is now a distinguished pathologist, returned to Baltimore, about 1881, after two years of what to him was an intellectual orgy in pathological institutes of Vienna, he made the mistake of presuming that his unique acquirements might be the source of a living wage as a consulting specialist on pathology in his home city. The hope proved futile, for the medical profession had not the education necessary to formulate questions on conditions it did not recognize as problems.

Though in Philadelphia, in 1876, the indomitable energy of men like H. C. Wood and Weir Mitchell, to be followed in a half decade by a galaxy of pupils, not duplicated in later years, was producing original investigation of greater or less value, there was no laboratory with the specific object of inculcating and hatching original thought in physiology. H. P. Bowditch, of Harvard, by reason of his training under Ludwig and his intrinsically high endowments, was the worthy dean of experimental physiological science in America. In contrast, I may recall that for the past decade or more every year there have come to us from a score or more of laboratories a host of original contributions in every field of biological research.

Indeed, to-day every respectable medical school has its laboratories of physiology and pathology and these, with few exceptions, are the loci of original research. To-day every branch of medicine and surgery is represented by a select coterie of active workers known as this or that society or association, who make their investigations wherever material offers, in the clinic, the laboratory or by the bedside. The distinctively laboratory branches of medical science are chiefly represented in the "Federation of American Societies for Experimental Biology" founded in 1913. This association was made by the aggregation of already existent societies, namely: The American Physiological Society, founded December, 1887; the American Society of Biological Chemists, 1906; the American Society for Pharmacology and Experimental Therapeutics, 1908; the American Society of Experimental Pathology, 1913. The total list of membership in 1922 comprised 539 names, all of them those of producing workers for the advance of biology, especially as related to medicine. A most active and productive institution of the same ideals is the Society for Experimental Biology and Medicine, founded by Meltzer in 1903. Its 19 charter members have multiplied to a roster of 549 in 1923. Other similar organizations of national scope, such as the Society for Clinical Investigation, Society for Cancer Research, etc., deserve passing mention. The developments on the morphological side of biology have been equally noteworthy.

Nothing is more indicative of the volume and educational demands of the reading population than the number and character of the scientific journals which it supports. In the first small volume of the "Index Medicus," representing the literature for 1877, there are mentioned all told 64 medical journals, mostly of very mediocre quality, as published in the United States and Canada. Of these not one was devoted to scientific research. In the index of the *Journal* of the American Medical Association for 1921 out of 110 titles of journals from the same area no less than 22 are devoted wholly to original investigations in the biological sciences directly bearing on medicine, and in the remaining 88 journals dealing with medical specialties a large proportion of the pages is devoted to the publication of high-class original research.

In former days, there was a sharp distinction drawn by even the best medical minds between subjects which were scientific or theoretical and those which were of "practical" value. To-day the leading thinkers and operators in surgery talk familiarly of "surgical physiology," and every physician recognizes that he is likely to understand his sick man in proportion as he apprehends "clinical physiology."

We can maintain, therefore, that the period of the past 47 years has witnessed the birth and vigorous development of American biology, of which the supporting trunk is, and must ever be, physiology.

When in the middle seventies, Johns Hopkins, a citizen of Baltimore, determined to devote his great estate to the upbuilding of higher education and of higher medical education in particular, he chose as advisers a group of reflective and far-seeing men who for the most part had been trained in the self-restraint of a Quaker upbringing.

The soundness of judgment displayed by this body of technically ignorant citizens must remain an enduring monument to their sagacity and high character. They culled from the world advisers who were themselves broad humanitarians and foremost among the producers of scientific progress. Perhaps the chief among these were Huxley in England and John S. Billings in this country.

It was realized that education in this country, beginning in the primary school and ending in college, included a field of activity of two dimensions only. No upward growth could be hoped for except from teachers who could produce knowledge as well as impart it. Europe had already found that the development of sound education of any grade depended on the mitosis of original research carried on in laboratory and study of trained and devoted men. To

Europe our young men had been forced to migrate to get behind the scenes or read between the lines of their text-books.

The founders of the Johns Hopkins University determined to establish a new order of institution, one devoted primarily to original research and the critical study of existing knowledge.

Its main body of students from the outset was culled from college graduates, who felt the call of higher science, literature or mathematics. To-day, throughout the length and breadth of the land, the nodes of education are infiltrated with the spiritual enzymes propagated in the mother culture at Baltimore. What was taught there was, perhaps, not so important as knowledge as the way of looking at knowledge. Within the past month Dr. H. S. Pritchett,[3] president of the Carnegie Institute for the Advancement of Teaching, has publicly deplored the calamity suffered by American education through the alleged fall of Johns Hopkins University from its preeminence by reason of the diversion of its energies to the attraction of undergraduate students.

One of the main departments of the university was that devoted to biology which, as Huxley had defined, might be considered to include all the attributes of living matter, but as a matter of fact was there limited to what is known as zoology, the study of the lower forms of animal life, embryology and to animal physiology.

As head of the department of biology a young man was chosen, Henry Newell Martin, who was a direct product of the influence and teaching of the two most understanding men of biological science in England, T. H. Huxley and Michael Foster. The following characterization is largely directly drawn from a biographical sketch of Martin published twelve years ago.[4]

The study of physiology as implanted at the Johns Hopkins University by Martin in October, 1876, was a graft from English physiology, and it may be of interest to you to hear in the words of one of the foremost teachers of English physiology an account of the modern development of his science.

In England, as in America, physiological science from the time of Harvey and before had attracted the loving labors of great men here and there, but never had there been organized instruction in the experimental method, by which alone new discovery of function is possible, until the period of which I am about to speak.

When Sir Michael Foster stopped in Denver, in September, 1900, on his way home after delivering the Lane Lectures in San Francisco, he consented to talk before the local medical school of his own memories of physiology and physiologists in England.

By great good fortune Dr. W. N. Beggs, then editor of the *Colorado Medical Journal,* arranged for a stenographic report of the colloquial lecture, which may be found in the *Colorado Medical Journal,* 1900, VI, 419.

It seems to me to be one of the most living historical sketches I have ever seen and nothing can better serve my purpose than to quote from Foster's extemporaneous words. He says:

> It was in the year 1854 when I began my medical studies, but I had a year before attended a course of lectures on physiology breaking into my ordinary studies in order to do that, and my teacher was a man by the name of William Sharpey, a very great man but a man whose name, perhaps, will not occupy the place as that of a great physiologist which it really deserves. Those of you who have studied the structure of bone will remember his name under the title of "Sharpey's fibres." Indeed, he was one of the first to give an accurate description of the true structure of bone.
>
> He was at that time the only pure physiologist in England. . . . Sharpey may perhaps be known to you also as the editor of a book, which for years and years has been and still is a standard work in anatomy in England, "Quain's Anatomy," which deals not only with topographical anatomy, but also with minute structure, with what we now call histology; and Sharpey was the first man to teach histology in a thoroughly systematic method in England. . . . Now Sharpey was, at the time I am speaking of, the greatest physiologist in England, the only person who devoted his whole time to science; and yet even he taught physiology wholly by lectures. He had no physiological laboratory. He had no physiological apparatus whatever. All he did in the way of practical teaching at that time was to show us under the microscope preparations of various tissues. There was no attempt whatever at any practical teaching in physiology. I remember very well when he was lecturing on blood pressure, and was describing to us the then new results of Ludwig, endeavoring to explain to us the blood pressure curve. All he had to help him was his cylinder hat, which he put upon the lecture table before him and with his finger traced upon the hat the course of the curve. That was the way that physiology was taught by Sharpey in England in the year 1854. And yet Sharpey taught it as nobody else taught it. Nobody else in England then was teaching physiology as Sharpey taught it and, as I tell you, he used his hat, and a very old hat it was, as a kymographion, for blood pressure. I remember very well going to him one day after his lecture, in which he had been speaking of the functions of the liver (by that time he had recognized that I had a special interest in physiology) and he said to me, "Well," he said, "I didn't like to say anything about it in my lecture but Claude Bernard in Paris has just sent me a paper which he read before the Academy of Sciences at Paris, and in that paper he has proved that there is present in the

[3] *Scribner's Mag.*, May, 1923, p. 556.

[4] *Bull.* Johns Hopkins Hosp., 1911, xxii, 327.

liver a substance resembling starch which is easily converted into sugar.'' I said to him, ''Good gracious, that is something quite new, isn't it?'' That was Claude Bernard's discovery of glycogen.

In words which it seems a pity to delete, Foster goes on to describe how with the aid of Sharpey there was installed for the first time at University College, London, a subordinate position, a lectureship on practical physiology. Foster received the appointment about '64 or '65. But he says:

What could be done was very little. I had a small room. I had a few microscopes. But I began to carry out the instruction in a more systematic manner than had been done before. For instance, I made the men prepare the tissues for themselves. That was a new thing then in histology, and I also made them do for themselves simple experiments on muscle and nerve and other tissues and on live animals. That, I may say, was the beginning of teaching of practical physiology in England. . . . These lectures on physiology were absolutely voluntary, and only the better students were willing to give up the time needed to get a more thorough grasp of physiology. Well, I appointed a time to see the few who wished to spend some time in this new study of luxury, and there came to me a boy, nothing more than a boy, at least he looked like a boy, who said: ''I am very sorry, sir; I should like to take your course if I could, but you see my parents are not very well off, and I get my board and lodging by living with a doctor close by.'' Doctors in England then, as indeed they do very largely now, dispensed their own medicines. I mean when they saw a patient they sent in afterwards the medicines required. In those days medicines were not as compendious as they now are; the doctor could not take the whole pharmacopaeia about in a little case. He either with his own hand or by the help of an assistant had to do a good deal in the way of preparation of medicines, making infusions, rolling pills and making up mixtures and draughts, doing all the things which went under the general name of dispensing. The lad I am speaking of said to me, ''I have, in return for my board, to dispense all the doctor's medicines, and that dispensing takes from 2 to 5 o'clock; now your lectures begin at 4, I can not come for the first hour. You go on to six. May I come in for the second hour? I will work hard and try to make up the lost time.'' I said, ''Certainly, certainly.'' So he came in regularly late. The other boys rather laughed at his coming in late. He came in regularly at 5 o'clock and he worked with such purpose that, in the examination which I had at the end of the course, I awarded him the prize. Well, his name was Henry Newell Martin, and I was so struck with him that I asked him to assist me in my course and he became my demonstrator.

After we had been at University College for either two or three years, Martin carrying on his studies and at the same time helping me, he came to me one day in great trouble because he could not make up his mind. He had obtained what they call a scholarship at Christ College at Cambridge and he could not make up his mind to accept it and go there. He said he didn't want to leave me. But I was able to tell him what nobody else knew at that time . . . that I was going to Cambridge, too, having been invited to be a lecturer on physiology there. So we both went to Cambridge at the same time, and he became at Cambridge at once my demonstrator, as he had been in London, and after a career of considerable brilliancy of some years at Cambridge there came to him an invitation to Johns Hopkins University at Baltimore. So, if I have done nothing more, at all events I sent Henry Newell Martin to America.

Martin was born July 1, 1848, and he was therefore but 28 years old, and looked still younger, when he took up the duties of the most responsible pedagogic position in the United States. He was of Irish parentage and the eldest of twelve children. His father was a clergyman from the south of Ireland, at first a Congregational minister and later a school teacher. His mother, to whom he was manifestly greatly devoted, was from the north of Ireland. A unique course of laboratory work, designed to give a broad view of living forms and functions, had been introduced by Professor Huxley in 1873. Martin helped to import the course at Cambridge and later assisted Huxley himself and under his directions prepared the famous text-book on "Practical Biology."

Each epoch in the world's history is characterized by specific points of view and conflict of opinion on questions that seem for the moment all important. A perfect history would bring to us the environment in time, place, circumstance and feeling of any age.

As said in a previous sketch of Martin: "No adequate estimate of the specific educational forces at work in the late seventies can fail to take into account the influence on the youth of that period of the intellectual atmosphere emanating from the doctrine of evolution."

Darwin's "Descent of Man" appeared in 1871, and soon a strife was on between a protesting and enraged orthodoxy on the one hand and the often iconoclastic forces of thought-liberty on the other.

Professor Huxley, known affectionately by those near him as the "General," as the commander of a ship is known as "the old man," was the splendid and aggressive leader of the Anglo-Saxon believers in evolution. It is not surprising that the internal tempest bred by thoughts of the supernatural in the mind of every thinking youth should have found its outlet along the channels of reason as suggested by evolution when intolerant of traditions of mysticism.

To be frank, the popular notion that the prevailing spirit of the Johns Hopkins staff in those days, at least as regards the biological department, was "agnostic" was sufficiently correct. To-day the conflict between the book of Genesis and science had long been as a tale that is told until a contemporary and a

neighbor of our own bethought him that faded fame might be polished with the ashes of this dead issue.

In those days the student was thrilled by the new demonstrations of the application of the law of the conservation of energy to the living body and a definition of physiology as the "chemistry and physics of the living body" was made with arrogant good faith.

The old doctrine of "vitalism," by which the masters for centuries had explained the phenomena of life, was thought to have been buried forever. It seemed as if at last the phenomena of life itself were soon to surrender themselves to the art of mathematical treatment. But since those days a panorama of discoveries has again well-nigh reduced us to chaos in belief. Then we knew nothing of hormones, of internal secretions, of vitamines, of the ubiquity of enzyme action in vital phenomena. Colloidal chemistry was a nursling. There was no worthy conception of specific surface energies, of adsorption or of ions. The atom was still the ultimate indivisible unit of matter. But, withal, to-day doubt still withholds a verdict as between the mechanistic and vitalistic conceptions of life.

It was one of the chances which determine the course of human life by which it happened that your speaker, a native of Baltimore, graduated at the age of 21 from a New England college some three months before the inauguration of the Johns Hopkins University. His design of studying medicine, which had been constantly in view from the earliest days of volition, found a peremptory obstruction in the lack of funds necessary to such a course.

But thrilled with the divine curiosity concerning the nature and operation of the forces of life, the main thing was to get a chance to study under a competent teacher. A member of the board of trustees of the university secured for me an appointment to visit Professor Martin, whose sufficient distinction it was to have been an associate of Huxley, that grand Napoleon of biological science, who had already enthralled the youth of two continents.

I called on Professor Martin at his rooms and my spirits were lightened when I saw a very young man—he was then 28 and looked younger—who treated me at once something like a companion. He was scarcely of medium height, of slight but well-developed frame. His head was rather small, the eyes blue and wide-open, nose thin and fine, complexion fair and mustache blond. His dress was always strikingly neat, without being foppish. I can not but fancy that Martin then was homesick and keen to relish the devotion of one not far from his own age. Martin accepted me as his assistant in the biological laboratory at a stipend of $250.00 for the first six months. . . .

Martin's ability as a teacher is attested by the eminence of many pupils; his talent as an investigator is recorded in the literature of physiology; but the personality of the man, his kindly tact, the sincerity, the unassuming modesty, devoid of self-consciousness, the loyalty to truth and the indefinable emanation that reaches from man to man, the memory of these is apt to fall with the heartbeats of his companions. I well remember the first week of preparation for class work. There was as yet no laboratory "Diener," and a hundred tasks of household preparation were to be completed in advance. Martin was kinder than he could have known when he stood beside his assistant washing bottles for reagents; and in this, as in every other field, what would have sorely hurt as a menial service he turned into the routine of technical manipulation. While he never gave way to sentimentality, his invariable kindness where he bestowed confidence withstood every strain of daily intercourse. On one occasion he loaned me overnight the manuscript of an important public address which was to be published. Next morning the roll was missing and apparently lost beyond repair, but the delinquent was the only one ruffled by the accident. To his great joy the papers were found to have been left on the counter of a friendly shopkeeper.

For one of his public lectures before a fashionable, and chiefly feminine, audience plans had been devised for the demonstration on a projection screen of familiar physiological activities, such as muscular contraction, reflex action and the heart beat in the frog. Unfortunately the apparatus was not available for proper rehearsal and when the fateful hour came, the nerves and muscles rebelled at the "lime light." Martin would graphically describe a function and then call for demonstration. Again and again I failed him and things looked desperate when he asked in the gloom of turned down lights, "Sewall, is your heart going?"

Humiliation was relieved by the titter that restored the humor of the fair audience. A lecturer might well feel murderous towards an assistant who so failed him, but if Martin felt that way he gave no sign. . . .

Looking back over the history of those days one must marvel at the felicity with which Martin made and then developed opportunities in the unbroken field before him.

Courses in practical biology and practical physiology formed the routine of laboratory work. But soon there were established accessory classes in demonstration and practice.

A selected number of teachers of Baltimore were offered a course of study on Saturday mornings. Listening first to a brief descriptive lecture by the professor, they then adjourned to the laboratory and with

their own hands and eyes carried on for two or three hours such a nature study as had not been conceived in those days.

It was a duty of your speaker to prepare material for that Saturday's class and the obligation fully occupied the spare time of the preceding week. The physicians of the community were invited to a course of physiological demonstrations and many eagerly availed themselves of the opportunity. Martin's unselfish and impelling nature sought the utmost development of all about him.

Martin soon came to be looked upon as the scientific exponent of the medical profession, and through lectures and practical demonstrations he illuminated the minds and raised the ideals of the more ambitious members of the cult. With infinite tact he made abstruse subjects so plain and practical that his hearers often volunteered as real students and helpers. . . . To my mind the most useful teaching of Martin's career is found in an analysis of the elements of his success. It was clear in his case, as has often been established in others, that his success depended on careful preparation for every effort made. I was very much impressed when, after I had spent two years in special study of gastric digestion and he had appointed me to make my maiden lecture on the subject, he asked me a full month before the time whether I had prepared my lecture yet. The thought sprang to my mind, "It may be that this ultra-preparedness has something to do with Martin's success."

Again, once when we were giving parallel courses to the same class, he in the morning and I in the afternoon, he one day apparently ran out of prepared material and to my horror, being one of the audience, he deliberately appropriated the most harmonious thunder I had laboriously stored for the afternoon. I hastened to privately reproach him on the subject, but he only replied, "It doesn't matter, it will do them more good to hear it a second time." This reminds one of the summing up which a great teacher, Michael Foster, I think, made of his pedagogic experience: "Every year I put less into my lectures and say it over oftener." I can recall but two personal criticisms Martin ever made to me; one was because of a tendency to neglect to expound familiar and obvious details in making a physiological demonstration and the other was for a proneness to procrastinate the preparation for a remote exposition.

Martin found time in 1880 to write an excellent text-book of physiology, "The Human Body," which has become very popular in colleges and in a short time a separate, condensed edition, "The Briefer Course," was prepared for use in secondary schools. Nothing that I have said predicates for Johns Hopkins University or its biological department a position of peculiar preeminence among American institutions of learning. Yet it is now a matter of history that to the university was conceded a unique position as an educational leader almost from the opening of its doors.

With phenomenal wisdom the administrators of the university chose for the heads of its departments men who were not merely good lecturers but were investigators and sources of inspiration in their respective fields. The three departments of natural science established, physics, chemistry and biology, were all under the direction of men still far short of middle age.

In those days the young men gathered there were all votaries of what Huxley called "the divine dipsomania of original research."

Of inexpressible value to us, often ill-formed but devoted students, were the precepts and examples of leaders trained in the way of making knowledge. Martin's achievements inculcated the encouraging lesson that the prime requisite of a successful investigator is not "genius" or even great talent, but above all, a faithful, unerring, insatiable desire for truth as a point of view to which must be added a working energy of indomitable persistence and guided by a faith that nothing happens without a reason.

Martin was not a voluminous writer. In his seventeen years of service in Baltimore there were produced by him but fifteen papers covering the results of original researches. . . . I very well remember one morning, I think it was in the fall of 1880, Martin said to me, in effect, "I could not sleep last night and the thought came to me that the problem of isolating the mammalian heart might be solved by getting a return circulation through the coronary vessels." The idea seemed reasonable, and at the close of the day's work we anesthetized a dog, prepared him for artificial respiration and then Professor Martin opened the chest and ligatured one by one the venae cavae and aorta in such a way as to leave sufficient amount of blood in the heart itself. The heart continued to beat in a normal manner, the circuit made by the blood being from the right side, through the lungs to the left side and back again through the coronary vessels in the heart wall to the right ventricle. Thus heart and lungs were completely isolated from the rest of the body and could be studied unaffected by the interference of factors foreign to itself. . . . Isolation of the mammalian heart by the "method of Langendorff" is now a common procedure. Probably few are aware of the real discoverer of the idea. It is interesting to note the character of the problems with which Martin busied himself, and his persistent search for an *experimentum crucis*.

Assisted by Sedgwick he apparently settled experimentally the disputed function of the internal intercostal muscles. They also succeeded in putting a

cannula in a coronary artery of the living dog's heart and directly measuring the blood pressure and pulse wave in the coronary system, though the great Cohnheim had laid down the dictum that occlusion of a main coronary artery was immediately fatal to the physiological action of the heart.

In Martin's time the leaders of thought in physiology felt themselves confronted with a calamity which endangered the autonomy of their science. Physiology in this country did not exist as a profession. Its reason for existence in the mind of even the educated public rested on its relation to medical instruction and it held somewhat the same position in the technical curriculum as grammar does in the academic course. Martin, following the lead of his scientific forebears, insisted that physiology should be regarded as the benefactor not the handmaid of medicine and that it should be cultivated as a pure science absolutely independent of any so-called practical affiliation.

Martin glimpsed the future as by inspiration.

The vast development of our conceptions of vital reactions as manifested in the doctrines of immunity, has occurred wholly since his day. As he foresaw, the temptation to achieve discovery directly applicable to the cure of disease has attracted an overwhelming majority of those whose tastes and talents might have been devoted to a sounder development of the principles of science. The student and the prospector for precious metals both tend to rush to the new field of rumored richness.

The history of science is thickly studded with examples of facts and laws unearthed in the pursuit of pure knowledge which have turned out to be indispensable foundations of daily thought and action. Never could they have been discovered by one bent upon so-called "practical" or patentable information. Both theory and experience combine to uphold the doctrine that *knowledge,* irrespective of human uses, must ever be the foundation of both intellectual and material development.

To come, now, down to a focal conclusion and to try and distil in a sentence what would need a volume to elaborate, what should be our attitude towards offering facilities for research and for training in clinical practice, respectively, in medical education?

It has been postulated here that the original investigator is characterized by a specific trend of mind which makes him ever an amateur insatiate for new things, a type on which the advance of knowledge is almost wholly dependent. But such a type is no more fitted, *per se,* to carry on the details of medical practice or apply the fruits of discovery in the infinite vicissitudes of clinical experience than would the explorer or the pioneer settler of a new country be qualified by nature or training to conduct the civic affairs of a highly organized community.

To help humanity is the goal of mass education.

Science is worthless for the people until in applied art it is coordinated to approximate mechanical exactness.

The clinician must hope to acquire through long years of extramural education a method of thought and action not taught in the medical curriculum. A method to which, indeed, the requirements and attributes of experimental science are largely antagonistic; a peculiar point of view and a communistic method of dealing with human minds and conditions. It would be an egregious tactical blunder to attempt to train all students as investigators; but without injury to any, all may be given the opportunity of an environment to which may react a small percentage of minds attuned by nature to respond to the call of truth Promethean.

HENRY SEWALL
DENVER, COLORADO

RESEARCH COMMITTEES[1]

THE GROWING COMPLEXITY OF ORGANIZATION FOR RESEARCH

RESEARCH enjoys a vogue at present, fortunately and rightly. It is believed in almost as a religion, with much lip service. Lips are likely to be tightly closed when the collection plate is passed.

The organization of research and research committees proceeds apace, to the extent that the unit of ultimate value in fundamental research, that is, the individual research worker is encompassed about with so great a cloud of witnesses.

The American Society of Civil Engineers, the American Concrete Institute, the Western Society of Engineers have research committees and also certain governmental departments. There is the National Research Council, the Engineering Foundation, the research organization of the Association of Land Grant Colleges, which is one of the most powerful of the agencies.

Now, one aspect of science is the simplification and economy of thought, and one aspect of engineering is economy of action. It would be profitable to inquire into the function of any proposed committee before adding to the structure of such committees, in which duplication of effort is less defensible than in the activities of research workers themselves.

For indeed parallel attacks on any research problems are desirable. It is only necessary that researchers should have a knowledge of mutual progress, and

[1] Discussion read before American Society for Testing Materials, June, 1923.

a clearly defined objective placed in its setting in the particular field. It is well, for instance, that the highway department of Illinois, the University of Maryland and Purdue University should have attacked the problem of fatigue of concrete independently.

ON RESEARCH IN GENERAL

In academic circles special attainments in two different fields are signalized by two honors—the Phi Beta Kappa and the Sigma Xi, the former in the field of humanities and the latter in scientific research wherein the truth is sought through the study of nature. I do not know how to draw a line between the fields of so-called academic research and so-called industrial or engineering research. Each must advance, if at all, by scientific methods. Considered as a class set apart by their tastes and their aptitudes from the class of producers and constructors, research workers are of a family.

In a recent conversation with a friend whose mental acumen I admire greatly, but whose narrow definition of research I deplore, it seemed to me that there might be a need to attempt to describe some of the characteristics of research. I would suppose that the quality of a research worker is a spiritual quality and is not to be measured by specific actions. Therefore, there is a danger in attempting to formulate a measure. Certainly, there is a clear distinction between the research type of man and the other who has an instinct for controlling others or for production.

My lot has been cast in with those who experiment or perform research in groups; with a program fixed in advance, and an organization to carry it out. Some of the individuals of the group are only required to be painstaking and faithful observers, to be devoted to their task of measurement with precise instruments, whether in the heat of summer's sun or the freezing weather of winter, in confined situations and fatiguing postures. Others have envisaged the problem, organized and secured support for its solution; they may have prepared a working plan, or left that to others.

Some time ago I gathered together from various sources, chiefly from a report of committee of Sigma Xi, a list of the features of research, as follows:

(1) Research work may be in *industrial* fields with a definite aim or in *abstract* science without thought of particular use.

(2) The research may lie in the field of any branch of knowledge that is treated in a scientific spirit, including, of course, the natural sciences, but not excluding mathematics, history, economics and medicine.

(3) The *method* may be by *deduction*, based upon natural phenomena, and always referenced thereto, or by *induction*, using the methods of modern experimental science, both to discover new facts or uncover underlying laws, or the determination of the mechanism by which one event follows another, resulting in a substantial addition to the existing body of knowledge.

(4) The *qualities* by which true research are known are: earnestness, devotion, diligence and system, and in highest form, original and creative work.

(5) Recognition should be given to skill and initiative in devising suitable methods and apparatus for use in observations, and care and devotion shown in difficult observations, skill in arranging and interpreting data, or forming generalizations upon them.

(6) The *result* should be the discovery of something hitherto unknown.

The following are activities and workers not considered:

(1) The work of the mere routine worker without initiative or responsibility.

(2) The manual operations of the mechanic.

(3) The work of the merely critical and negative mind.

(5) Purely regulatory functions.

(6) Those with only the acquisitions of the learned scholar who may have absorbed the results of research.

(7) Inventors, unless they are scientists.

Anatole France has well expressed one fundamental quality of the research worker, namely "curiosity," in the following quotation:

> Et je songeai que la grande vertu de l'homme est peut-être la curiosité. Nous voulons savoir; il est vrai que nous ne saurons jamais rien, mais nous aurons du moins opposé au mystère universel qui nous enveloppe une pensée obstinée et des regards audacieux; toutes les raisons des raisonneurs ne nous queriront point, par bonheur, de cette grande inquiétude qui nous agite devant l'inconnu.

FUNCTION OF RESEARCH COMMITTEES

In the first place such a committee must deal gently with the individual researcher. He is often temperamental; he instinctively resents a control which will limit his freedom to follow new paths that open up in the progress of his work; he is apprehensive that he will be betrayed into premature publication by those who are charged with the duty of securing funds to keep the research alive; he guards the product of his research against appropriation by others for unfair credit. Initiative, originality and play of the imagination of the individual investigator must be given free rein.

The personality of the individual researcher should also be guarded in respect to his individual style and

expression in reports, and should not be destyled by editors who reduce everything to dull monotony of official forms. The conclusions of a man who has lived through an investigation should not be whittled down by timorous officials.

And yet here arises a practical difficulty, *viz.*, the proper balance between necessary control by an organization and the individual initiative of the research worker, in the case of large projects such as those underlying the art of highway construction where are involved large expenditures; an organization of researchers comprising various degrees of experience, from routine observers and recorders up to those who conceive and plan the researches and who are responsible for the scientific conclusions and the success attending the expenditures of such large funds. There are also individuals whose services are necessary for the orderly progress of the work, considered as a production job.

Projects are begun only after a statement of definite purpose, a working plan and an appropriation of funds, followed up by an accounting system, not only for expenditures, but from the standpoint of production. The problem here is to provide an effective organization without dampening the initiative of the individual, killing his imagination and destroying that sense of criticism and responsibility which are necessary if large projects in an unknown field are to arrive at useful and significant conclusions.

Where, then, does a research committee find its field of usefulness when not supplied with funds for operating a specific project? It seems to me that such a research committee functions as a staff organization. I have endeavored to define these functions for the research committees of the advisory board on highway research as follows:

(1) The entire purpose of a research committee is to render service to investigators, and to accelerate progress in the attack upon important problems. It avoids any attitude of proprietorship in the researches which form the subject matter of its deliberations, or of any control or direction of the individual researcher, whose initiative and freedom are necessary conditions of his work. Coordination of research is attempted, inspiration given to those who are at work, and the broad interests of research advanced by reasonable publicity concerning activities. Information of work under way is spread abroad so that seekers after knowledge may know where to find it; communications established between fields of research.

(2) Research committees do not formulate standards of methods of test, or approved practices in construction.

(3) Reports of these research committees are not channels for publication of investigations, although a summary of established conclusions from published investigations should appear in the reports to show the status of research.

(4) The unique work of the research committees is:

(a) To bring together researchers who are working in the same field in order to reach a definition of objectives, and to bring to each researcher a knowledge of the technique and progress of his fellow workers.

(b) To assemble, analyze and review the published data of investigations, or the data placed at the disposal of the committees for the purpose of judging the extent and stability of the research basis for standards, or for the principles and laws underlying the field of the work of these committees.

(c) To study needed and profitable research activities.

(d) To stimulate competent agencies to perform research in such fields.

(e) To prepare working plans for specific researches in cooperation with investigators or for submission to research agencies.

(f) To call attention to researches which need financial support, and to recommend a means for securing such support.

(g) To publish information of researches under way, and of the tools of research, as instanced in Bulletin No. 21, entitled "A Census of Highway Research Projects in the United States" published by the National Research Council, and Bulletin No. 35, describing apparatus used in highway research.

Of these services the three outstanding are:

(1) The coordination of the researchers in connecting fields. For instance, the objective of certain researches by highway engineers must be established only in consideration of the traffic on the road. The automotive engineer and the highway engineer should be brought into conference for a definition of their appropriate fields of work and lay out programs of research.

(2) A committee may render valuable service in surveying the data of research to appraise progress and recommend further work; and also evaluate the application of research work in the industry.

(3) A particular field of usefulness is to bring into close relation the laboratory and the field, because very often laboratory men have very meager knowledge of the service of the material, and the requirements fixed by the laboratory may be quite unreal and not appear in the service value of the construction.

THE RESEARCH COMMITTEE FOR THE A. S. T. M.

If only for internal service in the A. S. T. M., a research committee of this society would seem to be necessary to perform these duties in the field of materials of construction where areas overlap, and there is so much of technique in common. Furthermore, the critical scrutiny by competent persons, of the fundamental data of research underlying the work of any

committee would serve to postpone premature standardization and would indicate necessary additional experimentation. I venture also to suggest that the work of such a research committee would prevent, or at least diminish, the tendency observed on the part of officials of the State Highway Commissions to go their own way in the establishment of specifications for materials that must meet the local needs and conditions of the widely varying regions of the United States.

PRACTICAL CONSIDERATIONS

It is not sufficient for such committees to set themselves at a table at scattered intervals without a large amount of preparatory work. A research committee needs analysts to prepare the data of research for scrutiny, not only published researches, but those which are complete or nearly so and have not reached channels of publication. The committee is not averaging opinions but rendering judgment upon complete evidence. It is only an illusion to suppose that a research committee can be useful without adequate financial support. Its value is expressed in terms of activity and not in an imposing roster of distinguished names.

RESEARCH AND STANDARDIZATION

The necessity of research before standardization has been well expressed by Mr. A. A. Stevenson, chairman of the American Engineering Standards Committee. To take an example: The standardization of colors for signals for highway traffic demands agreements as to conventions by a standardization committee. But underlying this agreement must be research upon the optical and psychological elements of the situation, to be cared for by a research committee. Otherwise the agreements may violate fundamental human reactions.

W. K. HATT
ADVISORY BOARD ON HIGHWAY RESEARCH,
WASHINGTON, D. C.

SCIENTIFIC EVENTS

GEORGE LEFEVRE AND THE MARINE BIOLOGICAL LABORATORY[1]

GEORGE LEFEVRE first came to Woods Hole as a Johns Hopkins University student in 1892, having a table in the Fish Commission laboratory, and he was there four summers. In 1897 he became directly connected with the Marine Biological Laboratory as an instructor in the zoology course. He served in this position for two years. Since 1905 he was continuously upon the staff for direction of zoological research; he was fourteen years a trustee and was secretary of the board for ten years. Few of the present or former members of the Woods Hole group have served the laboratory for a longer period. Five of Dr. Lefevre's publications are based wholly or in part upon investigations conducted here. Nearly every summer some of his pupils at the University of Missouri or some of the members of their zoological staff were at our laboratory, and six years the University of Missouri contributed to the financial support of the laboratory, all doubtless through Dr. Lefevre's influence.

But this bare statement of formal connections with the institution gives no adequate idea of the faithfulness of the service rendered, or of the influence of his fine personality and of his accurate work as an investigator. He was an outstanding figure in our Woods Hole group, his unfailing considerateness and courtesy, both as scientist and as friend, together with his genial sense of humor, contributing a large share to that wholesome atmosphere which has been one of the chief assets of this laboratory, so free from personal jealousies. George Lefevre was a sound zoologist who did much good technical scientific work; he was a keen critic, discriminating in suggestion; he was an inspiring teacher; he was an administrator of rare tact, good judgment and efficiency and our Woods Hole Laboratory, as well as his own university, had the benefit of his wise counsel. But, while recognizing to the full his strength as a scientist and as a leader and the thoroughness and devotion of his service to this institution, our chief remembrance of him will be as a sensitive gentleman, a tactful counsellor and a warm-hearted friend. The keen sense of our own loss in his death prompts us to try to express to his colleagues at the University of Missouri and especially to the members of his family our deep sympathy.

[1] From the Minutes of the meeting of the Board of Trustees and of the Corporation of the Marine Biological Laboratory held at Woods Hole, Mass., on August 14, 1923.

WORLD BIRD PROTECTION

MR. T. GILBERT PEARSON, president of the National Association of Audubon Societies, has demonstrated the possibility of creating a league for protecting the wild birds of the world. Leading scientific and conservation societies in nine countries have now organized and are pledged to active endeavors for the protection of the birds in their countries, and in aiding similar movements elsewhere.

This movement was launched at a conference held in London in June of last year. On invitation of Mr. Pearson delegates from several countries met in the home of the Honorable Reginald McKenna and determined that such action was necessary if much of the valuable bird life is to be saved from despoliation. Among the very active members of this conference

were Lord Edward Grey and Lord Buxton, of England; P. G. Van Tienhoven, of Holland, and the eminent naturalist, M. Jean Delacour, of France.

Mr. Pearson, who has just returned on the U. S. Steamship *Leviathan* from a lecturing and organizing tour through seven of the countries in Europe, writes:

Europe is looking to America for leadership in some of the lines of endeavor in which we as a nation have specialized. There is no country in the world that is so thoroughly organized and has such advanced laws for bird protection as the United States, and many of our methods can be and doubtless will be adapted to meet European conditions.

Through southern Europe especially very little attention is paid to bird protection. This may be illustrated by the fact that in all France in the year 1921 there were only sixty convictions for violation of the bird laws. During the same period in New York State alone there were more than one thousand. In Hungary I was told that during the past year with all of the thousands of bird killers in the country not one had been prosecuted. In Italy I saw nets, traps and various cages used to catch small song birds for food. There is a vast traffic in the bodies of these little songsters in that country. In Rome I saw in cages small birds whose eyes had been blinded by red hot irons on the theory that in their darkness they would sing better and thus prove more effective decoys in alluring other feathered friends to destruction.

Our International organization is now in effective operation in the United States, Canada, Australia, Norway, England, Holland, Luxemburg, France and Italy. Other countries have recently been invited to unite with the movement, and action by them may be expected soon. Members of the committee in the different countries are formed into national sections which deal especially with bird protective problems distinctly national in their scope.

Everywhere I went in Europe our plan was received most cordially.

INDUSTRIAL STANDARDIZATION

WE learn from *The Electrical World* that an unofficial conference of the secretaries of various standardizing organizations was held early in July at Zurich, Switzerland. This was the second conference of its kind held, the first conference having taken place in London in April, 1921. At that conference the secretaries of seven standardizing organizations were present, whereas at the Zurich conference secretaries from thirteen different countries were present. These included representatives from Austria, Belgium, Canada, Czechoslovakia, France, Germany, Great Britain, Holland, Italy, Norway, Sweden, Switzerland and the United States.

The conference, which lasted from July 3 to July 6, was given over to a discussion of the practical application of standards in the various countries and of the extent to which international collaboration is possible. There is a marked difference in industrial standardization and in the method of its application in the various countries involved. In Great Britain and in the United States the standardizing body is an industrial organization seeking government support, while in France, for example, the standardizing body is a government institution.

Reports were made by the various secretaries on progress in the different countries, and the American representative, Dr. Paul G. Agnew, was supported in his resolution that in order to help the cause of standardization ideas can not be exchanged too soon. Possessing no executive authority, the recommendations made by the secretaries as a whole will have to be placed before the executives of the respective national organizations. Progress has been made, however, toward closer international collaboration between secretaries and toward international amity on questions of standards. Mr. Zollinger, secretary of the Swiss committee, acted as chairman of the conference, and C. le Maistre of Great Britain acted as vice-chairman.

THE AMERICAN PUBLIC HEALTH ASSOCIATION

THE American Public Health Association extends to the public health profession and others interested a cordial invitation to attend its fifty-second annual meeting, in Boston, from October 8 to 11. Headquarters will be at the Copley-Plaza Hotel.

The annual meetings are always important events and the meeting this year is of more than usual interest since it ends the first twelve months of the new program adopted as a result of the association's reorganization in 1922. Two general sessions and twenty-six meetings of the scientific sessions will be held this year. In addition, many trips of technical and general interest have been planned in historic Boston as part of the entertainment and educational program. On Monday evening, October 8, the formal opening session will be followed by a reception. On Wednesday evening, October 10, Sir Thomas Oliver, the distinguished English industrial hygienist, and Dr. George E. Vincent, president of the Rockefeller Foundation, will address the second general session. The scientific program, embracing all branches of public health, will be held according to sections as follows: Public Health Administration, Laboratory, Sanitary Engineering, Vital Statistics, Child Hygiene, Food and Drugs, Industrial Hygiene, Public Health Nursing, Health Education and Publicity.

Among the subjects scheduled for discussion are papers on food inspection, growth of children, full-time health officers, mental hygiene in the school program, nutrition work, the effect of so-called moonshine liquors, standards for school house construction and

sanitation, epidemiology, better birth registration, organic heart disease, studies on the etiology of common colds, water supply and purification, mosquito control, etc.

A report of the committee on municipal health department practice will be presented before the section for Public Health Administration. At this time the announced plan for the awards to cities for distinctive community service will be discussed. The problems of health officers in small communities will be specially considered at a round-table discussion scheduled for Wednesday morning. The clinic on printed matter, which has proved valuable in past years, will be held again this year by the Section on Health Education and Publicity. At this clinic, samples of public health publicity will be examined and criticized by experts. Of special interest also is the report of the committee on health problems in education of the Section of Child Hygiene.

The September issue of *The American Journal of Public Health* carries the preliminary annual meeting program arranged by sections, and the October journal will contain additional information. Members of the association, traveling by rail to Boston, may secure a reduction of one fourth the regular round-trip rate.

THE LAKE STATES FOREST EXPERIMENT STATION

THE new Lake States Forest Experiment Station, as was reported here last week, is to be established at St. Paul, Minnesota, in cooperation with the Minnesota Agricultural College. The selection of a site for the new project in forestry research recently authorized by the Congress has been under consideration for some time. Owing to the presence of the Forest Products Laboratory and the ease with which cooperation might be effected between the new station and the older branch of the Forest Service, Madison, Wisconsin, was given serious thought as a site. It was decided, however, that the greatest good would result from the St. Paul location. The first problem to be undertaken by the experiment station will be the reforestation of the Upper Peninsula and the northern part of the Lower Peninsula of Michigan.

Although the experiment station is not to be located in Madison, its staff plans to cooperate fully with the authorities of the University of Wisconsin, the Conservation Commission of Wisconsin and with the Forest Products Laboratory.

It is the plan of the department of agriculture to have the Forest Experiment station do for forestry what agricultural experiment stations do for farming. To grow timber crops on idle lands unfit for agriculture and to perpetuate the hardwood lumber supply upon which the great furniture and woodworking industries of Michigan, Minnesota and Wisconsin depend, are the primary objects of the Lake States Station.

Dr. Raphael Zon, of the Forest Service, is to be the director of the new station. Dr. Zon, who enjoys an international reputation as a forester, has been identified with experiment stations for the past twenty-two years. He happens, moreover, to have a particularly wide knowledge of forestry in the Great Lake states.

Other members of the headquarters staff of the new station include Joseph Kittredge, Jr., who is now the chief of the office of forest investigations in the Forest Service, and A. J. Mitchell, a graduate of the Michigan Agricultural College, who has worked for many years in the Lake States in connection with fire protection organization. H. Grossman, a graduate of the University of Michigan, who has had considerable experience on the National Forests in the Northwest, and A. F. Wackerman, a graduate of the University of Minnesota, complete the staff as at present formed, thus giving the new station the services of men who are well acquainted with forest conditions in the Lake States.

One of the main purposes of the new Forest Experiment Station, which will be regional in character and which will devote its efforts to the problems of the Lake States as a whole, will be the correlation of the forest research and related interests and activities so that the maximum results may be accomplished without wasteful duplication.

As one of the means to bring about such a correlation, the Forest Service plans to organize a research council in the Lake States. This council will consist of representatives of the state department of forestry, forest schools, agricultural colleges, as well as representatives of the lumber, pulp and paper, furniture and wood-using industries in the Lake States region.

It is planned to have the council act in an advisory capacity for the Lake States Experiment station in suggesting problems that stand in need of solution, and in suggesting localities where studies should be made. It will also act as a clearing house for all forest investigations that may be conducted in the region, so that if a particular problem is already being studied at a forest school or by some state forest department, no attempt will be made to duplicate that study. On the contrary, such studies by the existing agencies will be encouraged, and the time and resources of the Federal experiment station devoted to other problems.

FELLOWSHIPS IN MEDICINE OF THE NATIONAL RESEARCH COUNCIL

DURING the first year of the operation of these fellowships thirty-one (31) individuals were appointed for work in the various fields of medicine and in dif-

ferent universities and institutions. A considerable number of these fellows requested reappointment for continuation of their work at the same place or elsewhere and of these fourteen were reappointed, as listed herewith:

Name	*Place of Work*	*Specialty*
Albritton, Erritt C.	Ohio State University	Physiology
Andrus, William D.	University of Cincinnati	Surgery
Anson, Barry J.	Harvard Medical School	Anatomy
Bent, Michael J.	College of Physicians and Surgeons, New York City	Bacteriology
Cone, William V.	Iowa State University	Neuropathology
Curtis, George M.	Rush Medical School	Surgery-Medicine
Davis, Loyal E.	Northwestern University	Neuro-surgery
Ferry, Ronald M.	Harvard Medical School	Biochemistry
Lennox, William G.	Harvard Medical School	Medicine
MacCready, Paul B.	Johns Hopkins Medical School	Laryngology
McLean, Jay	Leipzig	Surgery
Reznikoff, Paul	Harvard Medical School	Physiology-Medicine
Rosenthal, Sanford M.	Johns Hopkins University	Pharmacology
Shibley, Gerald S.	Columbia University	Medicine

Following a recent decision of the Medical Fellowship Board, for a time at least, no fellows will be appointed directly for work in a clinical branch of medicine unless they have served or plan to serve an apprenticeship in one of the medical sciences. With this purpose in mind, a limited number of new fellows were appointed for the ensuing year, beginning July 1, 1923, or shortly thereafter, as follows:

Name	*Place of Work*	*Specialty*
Andrus, Edwin Cowles	University of London	Physiology
Barker, Howard B.	University of Michigan	Anatomy
Kleitman, Nathaniel	Oxford University, England	Physiology
Morgan, David P.	Harvard Medical School	Biochemistry
Schwartze, Erich W.	University of London	Pharmacology
Scott, Joseph M.	Johns Hopkins School of Hygiene and Public Health	Bacteriology and Parasitology
Smith, Harry P.	Columbia University	Chemistry and Pathology

Other appointments may be made for the ensuing year at the meeting of the board to be held in September from a considerable list of candidates that applied on or before August 1.

FREDERICK P. GAY
CHAIRMAN, MEDICAL FELLOWSHIP BOARD,
NATIONAL RESEARCH COUNCIL

SCIENTIFIC NOTES AND NEWS

THE ninety-first annual meeting of the British Association for the Advancement of Science opened at Liverpool on September 12 with the presidential address of Sir Ernest Rutherford.

AT the Edinburgh meeting of the International Physiological Congress an invitation to meet in America was presented by Professor A. J. Carlson, president of the American Physiological Society, and an international committee was appointed to consider the possibility of accepting it for 1926.

THE International Congress of Psychology at Oxford also considered the question of meeting in the United States three years hence.

PROFESSOR I. P. PAWLOW, of Petrograd, was present at the International Physiological Congress, at which he made one of the three general addresses and was one of the members receiving honorary degrees from the University of Edinburgh. It will be remembered that he was refused a British *visa* on leaving New York. We learn from *Nature* that permission to land at Southampton (instead of Cherbourg) was obtained by wireless telegraphy during the voyage, through the enterprise of an American colleague and fellow-passenger, who communicated with an English physiologist.

THE nineteenth South African Medical Congress will be held next year in Grahamstown, Cape Province, under the presidency of Dr. E. G. Dru Drury, of Grahamstown.

A GERMAN Society for Dental Anatomy and Pathology has recently been founded under the presidency of Professor Römer, director of the Leipzig University Dental Institute.

LESLIE C. BEARD, Jr., instructor in chemistry in Johns Hopkins University, has become a chemist for the Standard Oil Company of New York. Raphael Rosen, who received the doctor's degree from Clark University in February, has joined the research staff.

E. B. BROWN, who during the past two years has

held the National Tuberculosis Association Fellowship in organic chemistry and biochemistry at Yale University, has resigned to accept a position as research chemist in the Fleischmann Laboratories.

E. J. CASSELMAN, of the Westinghouse Electric and Manufacturing Company, has accepted a fellowship in ceramics at the Mellon Institute.

FRANK B. GORIN has been appointed chief of the heavy chemicals section of the Chemical Division, Bureau of Foreign and Domestic Commerce.

DR. RHODA ERDMANN, formerly connected with Yale University, has been placed in charge of a special department of the Institute for Cancer Research at Berlin for cultivation of tissue cells outside the organism.

THE *Journal* of the American Medical Association reports that the Japanese government's subsidy for the encouragement of medical research for the present year (amounting to about 53,000 yen) has been given to some fifty research workers in fifteen medical colleges, eight special schools of medicine, pharmacology and dentistry, and two institutes. Some of the beneficiaries are: Professor T. Irisawa of the Tokyo Imperial University Medical College for his work on "Influence of Rice-Bran Extract on Beriberi"; Professor J. Simazomo, Kyoto Imperial University Medical College ("Nutritive Value of Japanese Food"), and Professor M. Yamado of the Nagasaki Medical College ("Therapy of Filaria Bancrofti").

A SENIOR Bert Memorial Fellowship of the value of £600 per annum has been awarded to Dr. David Keilin, a fourth year fellow working under Professor G. H. Nuttall, F.R.S., at the Molteno Institute for Research in Parasitology, University of Cambridge, on the life-history of parasitic protista and on the physiology of parasitic metazoa. A fourth year fellowship of the value of £400 per annum has been awarded to Miss Katherine Hope Coward, D.Sc., now working at the biochemical laboratory, Institute of Physiology, University College, University of London, on an investigation into the process of metabolism, nutrition and growth of young animals, particularly with reference to so-called deficiency diseases, such as rickets.

MR. D. C. CARROLL, Trinity Hall, Cambridge, has been elected to the Michael Foster research studentship, and Dr. C. C. Worster-Drought, Downing College, has been elected to the E. G. Fearnsides research scholarship.

THE two prizes offered by the Medical and Surgical Society of Guayaquil for the best reviews of the work of Pasteur were awarded to Dr. F. López of Quito and Dr. Luis Espinosa Tamayo of Guayaquil. A silver tablet with inscription was the first prize. Both articles are to be published in the *Anales* of the society.

DR. HAROLD I. GOSLINE, clinical director and pathologist at the State Hospital for Mental Diseases, Howard, Rhode Island, has been called to the position of chief psychiatrist and clinic director of the Dallas (Texas) Child Guidance Clinic.

DR. HENRY FAIRFIELD OSBORN has sailed for Mongolia from Seattle to join the third Asiatic expedition of the American Museum of Natural History.

IT is reported that Professor W. T. Councilman, of the Harvard Medical School, and Mrs. Councilman, *en route* to Peking, left the Tokio region before the disaster in Japan and are safely on the way to China.

PROFESSOR W. G. CADY, of Wesleyan University, has returned from a half year's leave of absence abroad, in the course of which he made a series of comparisons of radio wave-length standards in Italy, France and England. A set of piezo-electric resonators, which had previously been calibrated at the Bureau of Standards, served as high-frequency wave-length standards, and were compared with wavemeters of other standards in Rome, Livorno, Paris, Teddington and Farnborough.

A STAFF of government experts will sail from Seattle on September 11 for the Philippines to study the possibilities of rubber production in the islands. The survey to be made is in connection with the investigations being conducted by the Department of Commerce to locate areas for American controlled rubber production to combat foreign monopolies of the supply of the raw material. The party to make the investigation in the Philippine Islands consists of C. F. Vance, of Troy, Ohio, special agent of the department, in charge; A. H. Muzzal, of Carpinteria, Calif.; John P. Bushnell, of Washington, D. C., and Marl Baldwin, of the Bureau of Soils of the Agricultural Department.

A RADIO message has been received from Donald B. Macmillan stating that his Arctic Expedition has reached latitude 78° 30′. This indicates that *The Bowdoin* has reached Etah, on the northwest coast of Greenland, 2,300 air miles north of Boston.

NORMAN CLYDE, a teacher of Weaverville, Calif., on August 24 completed for the first time the ascent of Mount Wilbur, 9,293 feet high, in Glacier National Park.

DR. C. U. ARIENS KAPPERS, director of The Netherlands Central Brain Institute, Amsterdam, has

sailed from Marseilles en route to Peking, where he will give lectures in the Union Medical School, during the coming session. In his absence Dr. C. J. van der Horst, assistant director of the institute, will be in charge. During the summer, American workers at the laboratory have been Dr. W. H. Addison, of the University of Pennsylvania, and Dr. H. H. Charlton, of the University of Missouri.

SIR THOMAS OLIVER, the British authority on occupational diseases, arrived in New York on September 1. He will address the St. Louis Medical Society, the National Safety Congress and the American Public Health Association.

DR. F. L. HOFFMAN, chairman of the Committee on Statistics of the American Society for the Control of Cancer, will contribute an address to the forthcoming Belgian National Congress on cancer.

THE eighth summer meeting of the Mathematical Association of America was held at Vassar College, Poughkeepsie, New York, on Wednesday and Thursday, September 5–6, in conjunction with and immediately preceding the summer meeting of the American Mathematical Society which will continue on Friday and Saturday. A joint session of the two organizations was held on Thursday afternoon, and the joint dinner was held on Thursday evening.

THE next meeting of the American Electrochemical Society is to be held in Dayton, Ohio, on September 27, 28 and 29, 1923. The meeting will include a symposium on electrochemistry of gaseous conduction, in charge of Duncan MacRae, Research Laboratory, Westinghouse Lamp Co., Bloomfield, N. J., and a symposium on recent progress in electrolytic refining, under the chairmanship of F. R. Pyne, U. S. Metals Refining Co., Carteret, N. J. An innovation at the meeting will consist of round-table discussions on electric-furnace brass-foundry practice, organic electrochemistry, chlorine and electroplating. There will also be excursions to local plants.

THE 1923 convention of the Illuminating Engineering Society is to be held September 24 to 28, inclusive, at Lake George, N. Y. A well-balanced program of commercial and technical papers is being prepared by the committee under the direction of Mr. J. L. Stair, of Chicago. The officers of the general convention committee are: W. D'A. Ryan, *chairman;* H. W. Peck, *vice-chairman,* and H. E. Mahan, *secretary.*

AN International Congress for Cattle Breeding was held at the Hague from August 29 to September 4. The program included both beef and dairy cattle, with technical problems of heredity and nutrition, and with practical questions such as registration, government assistance, etc. The secretary was H. G. A. Leignes Bakhoven, Leeuwarden, The Netherlands.

AN international congress on dairying, known as the World's Dairy Congress, will be held at Washington, D. C., on October 2 and 3, at Philadelphia, Pa., on October 4 and at Syracuse, N. Y., in connection with the National Dairy Exposition, from October 5 to 10. Thirty-six countries have accepted President Harding's invitation to send delegates. The program, in addition to discussions of economic and business questions, will include some 200 papers on the breeding and nutrition of dairy animals, the chemistry and bacteriology of milk and milk products and on the nutritional value of milk in the diet of children.

AT the sixth annual meeting of the Northwestern Association of Horticulturists, Entomologists and Plant Pathologists, held at Boise, Idaho, from July 23 to 26, over sixty scientific men were present from Oregon, Washington, Idaho, Utah, Montana and British Columbia. The officers elected for the coming year are as follows: *President,* C. W. Hungerford, plant pathologist, University of Idaho. *Vice-President,* E. J. Newcomer, entomologist, U. S. D. A., Yakima, Washington. *Secretary-Treasurer,* W. T. Hunter, district horticulturist, Vernon, British Columbia. The meeting next year will be held in British Columbia.

THE seventeenth French Congress of Medicine was held at Bordeaux from September 27 to 29. The subjects for discussion include: (1) Remote sequelae of malaria, by Professor Le Dantec, Dr. Hesnard, Dr. Marcel Léger and Dr. Broden, of Brussels; (2) relationship of the sympathetic system and the endocrine glands in pathology, by Professor Pachon and Dr. Perrin; (3) treatment of meningococcal infections, by Professor Dopter and Dr. Boidin.

UNIVERSITY AND EDUCATIONAL NOTES

A DECREASE of 644 in the number of students of electrical engineering enrolled in 129 technical schools of the United States for the year 1922–23 as compared with 1921–22 is shown by figures compiled by Walton St. John of the United States Bureau of Education, the respective totals being 13,275 and 13,919. Similar decreases are shown in the registration for other branches of engineering, civil engineering, with an enrolment of 12,802, showing a loss of 1,590; mechanical engineering, with an enrolment of 14,453, a loss of 1,561; chemical engineering, with an enrolment of 7,054, a loss of 1,668, and mining and metallurgical engineering, with an enrolment of 2,895, a loss of 234.

DR. TOWNER R. LEIGH has been appointed director of the new school of pharmacy, for which money was pledged by the Florida State Pharmaceutical Association. It was opened at the University of Florida on September 10 by the state board of control.

DR. CLARENCE M. HYLAND, recently connected with Creighton University College of Medicine, has been appointed professor of pathology in the Bellevue Hospital Medical College, New York.

IN the University of Texas Department of Medicine, Galveston, Dr. H. O. Knight, formerly associate professor, has been promoted to full professor of anatomy; Dr. George E. Bethel, to be adjunct professor of anatomy, and Drs. G. W. N. Eggers, C. R. Enloe and E. M. Jordan instructors in anatomy.

JOHN L. EBAUGH, Jr., for the past two years instructor in chemistry at Tulane University, New Orleans, has been appointed instructor in chemistry at the Drexel Institute, Philadelphia.

DR. GEORGE EDWIN JOHNSON, professor of biology in the University of Porto Rico from 1917 to 1921, has been called to the chair of biology in the University of Mississippi.

DR. J. F. KESSEL, who has been during the past year university fellow in zoology at the University of California, sailed on August 21 for China, to take up his work as instructor in biology in the pre-medical school of Peking Union Medical College.

DISCUSSION AND CORRESPONDENCE

MEDICINE AND RELATED ARTS IN CHEMICAL LABORATORIES

THE attack on the medical profession in your issue of August 3, pages 79 and 80, based upon its supposed plan for insuring efficiency in clinical laboratory service, is unwarranted and destined to do harm. No such plan as that outlined by your correspondent, nor any other plan, has been adopted by the American Medical Association or by any of its scientific sections. Published records of the association (*Journal* A. M. A., July 7, 1923, page 35, and July 14, 1923, page 120), which were available to your correspondent, clearly show the extent to which the association has gone in this matter. Arrangements were authorized by the House of Delegates in June, 1923, at the request of the American Chemical Society, under which the association will cooperate with the American Chemical Society and other technical organizations in mapping out jointly a policy with reference to the control of clinical laboratories. The issue of a defiance and a threat by your correspondent, at this time and in such a way as to give them seemingly the support of the American Chemical Society, is hardly likely to contribute toward that cooperation which the officers of the American Medical Association and of the American Chemical Society have been at considerable pains to establish.

The Section on Pathology and Physiology of the Scientific Assembly of the American Medical Association, at its St. Louis meeting, 1922, upon the proceedings of which your correspondent seems largely to base his attack, did no more than create a committee to determine the practicability of standardizing clinical laboratories (*Journal* A. M. A., June 10, 1922, page 1810). The report of that committee, submitted at the San Francisco meeting in June, 1923, was unanimously adopted by the section and approved by the House of Delegates (*Journal* A. M. A., July 14, 1923, page 121), and stands as the action of the association. It provides merely for an investigation of clinical laboratories with a view to having some adequate supervision over them established. The papers and the discussion at the St. Louis meeting (*Journal* A. M. A., September 9, 1922, pages 861-867), to which your correspondent refers in support of his contentions and from which he quotes, represent in themselves merely the views of individual members of the association, not the views of the association or of the section. Even so, however, your readers will find little in them to support your correspondent's views concerning the attitude of the medical profession toward the activities in clinical laboratories of scientific men trained in fields other than medicine, and much to indicate medical appreciation of the work of such men. It is hoped that your readers will accept the invitation of your correspondent to read the papers and discussion referred to.

The medical profession has no need to be reminded of the extent to which the success of a physician and the safety of his patient depend on sciences and arts other than medicine. The American Medical Association itself long ago established its Council on Pharmacy and Chemistry and maintains at its headquarters a thoroughly equipped chemical laboratory under the direction of highly trained chemists. It is, in fact, the very dependence of medicine on certain related sciences and arts that renders it imperative that something be done to make certain that chemists, physicists, bacteriologists and others undertaking medical and quasi-medical work are fully qualified. It would be unfortunate, indeed, if indiscreet utterances on the part of any one should hinder the movement to that end.

WM. C. WOODWARD,
Executive Secretary
BUREAU OF LEGAL MEDICINE AND LEGISLATION, AMERICAN MEDICAL ASSOCIATION

AN INTERESTING COPEPOD FROM THE FINGER LAKES, NEW YORK

DURING the summers of 1910 and 1918, limnological studies were made on the Finger Lakes of New York for the United States Bureau of Fisheries. In these investigations a considerable amount of plankton material was collected from the lakes that were visited, but the various forms of crustacea were not carefully identified at that time. A more thorough study of this material recently led to the discovery of an unusually interesting copepod in the catches from the lower water of three of the lakes, namely, Seneca, Cayuga and Owasco. This copepod belongs to the calanoid group, but differs so widely from the other members that it represents a new genus and most probably a new family. A full description and figures of the form are being published elsewhere under the name of *Senecella calanoides*.

The female possesses only four pairs of swimming feet, while the fifth pair in the adult male is unusually large, extending well beyond the furcal rami, and greatly modified. Each antenna of the first pair consists of twenty-five segments in both sexes; the right one is exactly like the left one in the adult male, there being no geniculating modification of the right member. Each of these antennae bears fifteen sensory appendages in the adult male, but only seven in the female. In the adult male the oral appendages are reduced, the maxilla, mandible and first maxilliped being much smaller and weaker than those of the female and the immature male. The reduction is so marked, in fact, that it is difficult to see how the male can secure a sufficient quantity of food and masticate it with these reduced appendages. The significance of this reduction, therefore, is a very puzzling question. The modification of these appendages appears to take place during the last moult. Immature males having a length of 2.35 millimeters have these mouth parts as fully developed as the females, but mature males, which have a length of 2.45 to 2.55 millimeters, possess the reduced oral appendages. The female is somewhat larger than the male, ranging from 2.65 to 2.85 millimeters in length.

On the basis of its structure *Senecella calanoides* is more closely related to some of the marine calanoids than it is to any of the fresh-water members of this group. The closer relationship to marine forms suggests that this copepod may have reached the Finger Lakes during the marine invasion of the St. Lawrence valley following the last glacial period. At that time oceanic waters occupied Lake Ontario, forming a body of water known as Gilbert Gulf.[1] In a personal communication Professor H. L. Fairchild states that marine waters did not enter the Finger Lakes. Lake Iroquois, which occupied the Ontario basin prior to the marine invasion, sent a tongue into the Cayuga basin, but the Gilbert Gulf plane was 290 feet lower than that of Lake Iroquois. The passage of this form from Gilbert Gulf to the Finger Lakes was not accomplished, therefore, by a marine invasion of the latter, but by some other agency.

If this copepod reached the Finger Lakes by way of Gilbert Gulf one might expect it to adapt itself to the freshened state of the water at the end of the marine invasion and thus be an inhabitant of Lake Ontario at the present time; but this does not seem to be the case. Professor W. A. Clemens, of Toronto University, kindly loaned some plankton material which he collected in Lake Ontario on October 3, 1922, but *Senecella* is not represented in these catches which extended to a depth of 372 feet.

Two species of the larger copepods inhabit the cool lower waters of the deeper Finger Lakes, namely, *Senecella calanoides* found in Seneca, Cayuga and Owasco, and *Limnocalanus macrurus* in Canandaigua Lake; in none of the catches, however, were both species obtained from the same lake during the season covered by these collections, or from late July to early September. That is, they seem to be mutually exclusive during this time; it would be interesting to know whether this phenomenon obtains throughout the year and, if so, what factors are responsible for this exclusiveness.

CHANCEY JUDAY
GEOLOGICAL AND NATURAL HISTORY SURVEY, MADISON, WISCONSIN

[1] Studies in Indiana Geography, pp. 90–111. 1907; Bul. No. 209–210, N. Y. State Museum, p. 62, 1920.

THYROID CULTURES OF PARAMECIA

AT various times during the past year the writer has had occasion to make some thyroid cultures of paramecium caudatum. It was noted that these animals found this habitat more favorable to existence and reproduction than the ordinary hay-infusions.

Such a paramecium thyroid culture may be easily made by mixing about two grams of Armour's Desiccated Sheep Thyroids (U. S. P.) with 2,500 c.c. spring water. This mixture should be slightly stirred and allowed to stand exposed to the air for a half hour. Several pipettes-full of fluid containing paramecia are then introduced. If the culture jar is covered with a top and carefully sealed with vaseline an excellent, clear culture will be obtained. After several days it can be noticed that the animals are evenly distributed throughout the liquid, and are not congested about the top of the jar as in ordinary cultures. The cultures usually need but little attention. However, it is sometimes found desirable to add a little fresh water every week or ten days.

WILLIAM L. STRAUS, JR.
THE JOHNS HOPKINS UNIVERSITY

QUOTATIONS

BRITISH DYES

THE British Dyestuffs Corporation is something far more than an ordinary commercial enterprise; it is the practical manifestation of a deep-rooted determination of the nation to become independent of foreign sources for commodities as essential to commerce in peace as they are vital to self-preservation in war; the whole country through the Government investment in its capital has a stake in its success. In these circumstances the resignation of Dr. Green on the ground that he differs from the Board in regard to its adopted policy can not be passed over as a matter of private concern. Dr. Green thinks that the scientific side should be represented on the board, and he is not alone in his contention. On the other hand, the chairman announced at the annual meeting last year that in future the administration of the undertaking would be directed by a board of business men, who would retain the services of scientific experts at the head of the technical and research departments. That policy was endorsed by the shareholders and reaffirmed by them last month. Dr. Green, finding himself unable to agree with this view, has thought it right to offer his resignation, and the Board have accepted it. We feel sure that there will be general regret that so eminent a chemist should feel compelled to dissociate himself from the enterprise, but the personal aspects of the matter are of far less importance than the wider question of policy at issue.

During the four years ended last October the corporation and its associated companies spent over £400,000 on research. The sum is large, but the task of overtaking the German makers was extremely heavy. Before a maker is in a position to supply a dye to users on a commercial basis two things are necessary—its composition must be discovered, and its production on an economic basis must be ensured. Experience teaches that results in the laboratory alone are not by any means sufficient; there remains the task of the works staff in discovering how to produce the commodity in bulk of a quality at least equal to that offered by a rival concern and at a cost that enables it to be sold to the consumer at a competitive price. We understand that to-day the British Dyestuffs Corporation has established the constitution of colors available for commercial use, while Mr. Sutcliffe Smith, chairman of the Color Users' Association, declared last June that he had no reason for doubting the statement that British makers were now producing 80 per cent. of the color used in this country. That leaves a margin of 20 per cent. which British makers have not yet succeeded in producing on a commercial, as distinct from a laboratory, basis. To filling in the gap the Corporation is now devoting its energies, for the chairman announced at the annual meeting last month that henceforth the principal aim would be to utilize the research organization for the purpose of securing increased yields of products in actual manufacture and of introducing such new colors as are in steady demand by the consuming trades. In other words, the Board thought that the time had arrived when the effecting of economies in the cost of production and extending the range of dyes in demand by consumers were of greater importance than research prosecuted with a view to new discoveries. Justification for this view is to be found in the financial state of the Corporation's affairs and the urgency of the demand by consumers for reduction in prices. It must be remembered that the Corporation is only able to carry on because it is protected from underselling on the home market by Government restriction of imports. Such protection is absolutely necessary if the dye industry is to be established here; but it is impossible not to sympathize with the users' contention that they are bearing the burden of creating the industry and are placed at a temporary disadvantage through being compelled to pay a higher price than users who are in a position to import freely, and so to obtain the advantage of a depreciated exchange. On this ground alone the corporation is right to insist on rigid economy in all directions in order to cut costs to the lowest possible level.

There remains the question of finance, which is another vital factor in determining the policy of the board. When subscriptions were invited on the formation of the company, the inducement was offered that the government would protect the industry. It is true that the consumers have contributed their quota in assenting to the restriction of imports, and that the government has invested £1,700,000, but the shareholders are entitled to expect, under normal conditions, an adequate return on the capital they invested. In all they have received a sum equivalent to two per cent. on the average share capital employed, but last year they were faced with a trading loss amounting to more than the total dividends previously paid. In such circumstances, the prospect of raising further capital is remote, and as trustees for the shareholders the directors are bound to shape their policy with a view to establishing the enterprise on a sound commercial basis before their subscribed capital has been expended. If rigid economy is exercised there is good reason to believe that success will ultimately be won. At present, despite the restricted demand for its products, it is understood that the corporation is paying its way. With a revival of trade it should do better than that, and might prudently set aside larger sums for development work. Mean-

while, the first need is for greater efficiency in the commercial production of dyes in actual demand, and the second for the conservation of resources during an abnormal period. That is work for which men of business training are of greater value than men of scientific attainment, and the moment would not appear opportune for any change in the constitution of the board of directors.—*The London Times.*

SCIENTIFIC BOOKS

The Laws of Life: Principles of Evolution, Heredity and Eugenics. By WILLIAM M. GOLDSMITH, A. M., Ph.D. Boston, The Gorham Press, p. 441.

A LARGE, well-written and useful volume dealing particularly and most successfully with the problems of heredity in man and the conclusions based on our solutions of these problems.

Very many topics are treated by the author, in general sanely and accurately, with a wealth of illustrations and apt quotation. Much of this material ought to be part of the common knowledge of educated men and women, though at present this is far from the case. The main elements of eugenics especially should become as much a part of everyday knowledge as the causes of the succession of seasons—or even the multiplication table.

In the discussion of evolution, Dr. Goldsmith gives scant recognition to the theories and discoveries of Darwin. The conception of the formation of species largely, by abrupt mutation and Mendelian hybridizing, is not borne out in nature, and in nature our species exist. A species of animal or plant is a definable type of organism which has run the gauntlet of the ages and has *endured.* The extrinsic facts and factors of evolution should not be ignored or minimized. We know nothing of evolution *in vacuo,* and the even flow of life is modified, obstructed or split by conditions of environment. Separation and selection are elements in the formation of every species, the one preserving adaptations, the other permitting, by new conditions of selection, the persistence of variations.

In spite of the researches of mechanistic experimenters, our author does not believe that all phenomena of life can be summed up in terms of chemistry or physics. It may be that he takes too much pains to reconcile religious conceptions with the facts of nature. Science deals with truth so far as we can understand it, and it is one of its basal principles that we can never know the answer to any question until we find it out.

DAVID STARR JORDAN
STANFORD UNIVERSITY, CALIFORNIA

SPECIAL ARTICLES

THE REST PERIOD OF SOLANUM TUBEROSUM IN RELATION TO AVAILABLE NITROGEN

EXPERIMENTAL evidence has been secured that the slow growth of potatoes planted during their rest period may be due in part to the deficiency of available nitrogen in the tubers.

On September 28, 1922, seed pieces, 25 grams in weight, from tubers in the resting condition were planted in pure silica sand. One half of the cultures were treated with a complete nutrient solution containing equal molal (.007 mol.) proportions of the following salts, KNO_3, $MgHPO_4$ and $CaSO_4$. The other half were treated with a solution of the same total molal concentration, but which was altered so as not to contain nitrates, the KNO_3 being replaced by KH_2PO_4. Six weeks later tubers which had passed through their rest period were planted in the same kind of medium. These cultures were treated like those above, *i.e.,* half received a complete nutrient solution and the other half a solution containing no nitrate. The cultures of both series, resting and non-resting tubers, that received a complete nutrient solution appeared above ground during the first week in December. The cultures from resting tubers that did not receive nitrate appeared above ground a week later than the cultures of the same series that received nitrate. An examination before the appearance of the first sprouts showed, however, that the time of sprouting was approximately the same in both cases. All the cultures of this series produced single sprouts. The outstanding feature of this series, however, was the rapid development of the sprouts in the cultures that received nitrate as compared with those that received no nitrate. At the end of several weeks the difference was still more striking, the cultures that received nitrate were large and healthy plants, while those that received no nitrate were barely above ground. The cultures of the second series, non-resting tubers, differed from the above in that four to six sprouts developed instead of one. There was no significant difference in the dates the sprouts appeared above ground due to the presence or absence of nitrate, and, furthermore, the plants grew equally well during their early growth phase whether or not they received nitrate.

It is evident that on germination the physiological condition of tubers planted during the rest period is not the same as in normal non-resting tubers. The results obtained suggest that the breaking of the rest period in potatoes may depend at least in part on the